NOTES, ABSTRACTS, AND REVIEWS

GAIN AND LOSS OF TIME WHEN FLYING WITH AND AGAINST THE WIND

By W. J. HUMPHREYS

It is natural, perhaps, at first thought, to imagine that the time of a round-trip flight over a straight course is the same, other things being equal, regardless of the velocity of the wind along that course. At any rate, many seem to think that the time gained by flying with the wind a given distance is exactly equal to the time lost by flying the same distance against a wind of equal strength.

This is an error, and though easily seen it may be worth while to get a simple general expression for the time gained when flying with the wind, the time lost when flying against it, and the difference between the two.

Let l be the length of the course in miles; w and s the strength of the wind and speed of the airplane in still air, respectively, in miles per hour.

Then, in terms of hours:

Time in still air $=l/s$.
Time with wind $=l/(s+w)$.
Time against wind $=l/(s-w)$.
Gain with wind $=l/s-l/(s+w)=lw/s(s+w)$.
Loss against wind $=l/(s-w)-l/s=lw/s(s-w)$.
Loss minus gain $=2lw^2/s(s^2-w^2)$.

During equal intervals of time, however, the gain of distance with the wind is equal to its loss against the wind, and in each case is at the rate of w miles per hour.

Of course, all this is both obvious and old; nevertheless it may, perhaps, be a helpful hint to some who have not yet thought of everything that is obvious.

ON THE SEAT OF ACTIVITY IN THE UPPER AIR

By P. C. MAHALANOBIS

[Abstracted from *Memoirs of the Indian Meteorological Department*, Vol. XXIV, Pt. 1, Calcuta, 1923]

Dines and Shaw, upon the basis of relationships between surface and free-air pressures and other elements, as indicated by correlation coefficients, have reached the conclusion that the seat of origin of pressure changes lies in the substratosphere and the region above. Exner, Hesselberg, Köppen, Wedemayer, and C. K. M. Douglas have investigated the problem from the physical standpoint, and there is considerable controversy as to the validity of the conclusions that have been drawn. The author examines Dines's data from the statistical standpoint.

Dines infers that the pressure at the 9-kilometer level is the controlling variable, since the average numerical values of the correlation coefficients involving that factor are higher than those of any of the other variables. The author attacks the problem by attempting to determine the height at which the numerically greatest coefficients of correlation will occur.

Beginning with the hypsometric equation, the author arrives at the following identity:

$$B\equiv b/a=P_0Z/\,29.3T^2_z,$$

in which P_0 is the pressure at sea-level, Z the length of the air column, and T_z the mean temperature of the air column up to the height z. Transforming his equations into expressions involving correlation coefficients, it is found that the value of Z may be determined from the equation above when appropriate values of B are used, and these appropriate values of B must make the sum of the coefficients a maximum. This leads to

$$B=s_1\ (r_{12}R_1-R_2)/s_2\ (r_{12}R_2-R_1),$$

the several factors being defined as follows:

s_1 and s_2 are the standard deviations of sea-level pressure and mean temperature of the air column from 1 mk. to 9 km.;

r_{12} is the correlation coefficient between sea-level pressure and the mean temperature from 1 km. to 9 km.;

R_1 is the sum of the coefficients of correlation between sea-level pressure and any other variable x_n; and

R_2 is the sum of the coefficients of correlation between mean temperature of the air column between 1 km. and 9 km., and any other variable x_n.

Now, using Dines's data and the last equation above, values of B are found, whence correlation coefficients may be computed between the pressure at z km. and the various elements, sea-level pressure, mean temperature of the air column, 1 km. to 9 km., pressure at 9 km., height of the stratosphere, and temperature of the stratosphere, for which Dines has given values using pressure at 9 km. instead of at z km. The author's "constructed" set gives a value 14.7 per cent higher than Dines's.

To get at the values of B appropriate to various heights for use in Southeast England, the author takes temperature data from *Geophysical Memoir No. 13*, and assumes P_0 to be 1,014 mb., which, as will be seen from the first equation given above, will enable him to compute B for various heights, independent of Dines's coefficients. From values of B previously derived from Dines's coefficients, corresponding heights are calculated on the basis of the above temperature gradients and sea-level pressure. The result, based thus on Dines's data, indicates, in the author's words, "that the region from 2 to 4 km. is statistically more important than the region from 7 to 11 km. If statistical importance implies any causal or physicel significance, then the region from 2 to 4 km. seems to have better claims to be considered the seat of activity * * * than the substratosphere and the regions above."

The final portion of the paper is given to a brief discussion of Dines's treatment of partial correlation and partial regression coefficients of various orders in which several discrepancies between Dines's and the author's conclusions appear. This portion is not directly pertinent to the main discussion, hence will not be treated in abstract.—*C. L. M.*

ICE IN THE ARCTIC SEAS, 1923

[Reprinted from *Nature* London, May 3, 1924]

The Danish Meteorological Institute has published its well-known report on the state of the ice in the Arctic seas for 1923. In many respects the year was an exceptional one. In the Kara Sea conditions were unusually favorable, for not only the southern part ice-free in July, but also practically the whole sea was clear of ice in August and September, and probably much of October. The Barents Sea was unusually clear from April to the end of summer. In August there was open water to Franz Josef Land and the Wiche Islands and well to the north of Spitzbergen. Around Spitzbergen the ice conditions were also somewhat exceptional. Bear Island was clear of pack by the end of April, and the west coast of Spitzbergen had no ice of significance from May until November. The north coast was so free from ice that Spitzbergen was circumnavigated with comparative ease. While reports from the east coast of Greenland were few, there is evidence that ice conditions in that region were bad and that the ice was packed closely against the coast. In spring and early summer there was an unusual quantity of ice on the Newfoundland banks, but in Davis Strait the ice was scarce. Scantiness of information from many Arctic seas necessarily detracts from the value of this annual record, but it represents the only systematic collection of data relating to ice movements in which it may be possible in time to recognize some periodicity in occurrence.

RARE LUNAR HALO PHENOMENA

Mr. P. Connor, in charge of the United States Weather Bureau station at Kansas City, Mo., reports that at 8:20 p. m., April 16, 1924, a bright paraselene was observed on a segment of a 22° lunar halo for about 15 minutes. The colors presented by the paraselene varied from bright white to pink, the latter on the side next the moon. Between 2 and 3 a. m., on April 17, Mr. John Macy, of Woodston, Kans., observed a very bright paraselenic circle and the upper half of the 22° halo, together with bright 22° and 120° paraselenæ; neither the halo nor the paraselenic circle extended beyond their points of intersection; otherwise they were complete.

BALL LIGHTNING

The phenomenon of ball lightning is believed to have been observed by Mrs. R. V. Zimmerman at her home about 10 miles northeast of Charles City, Iowa, at 9 p. m. March 28, 1924. Mr. E. G. Larson, in charge of the Charles City Weather Bureau office, transmits Mrs. Zimmerman's account of the phenomenon, which is substantially as follows:

On Friday evening, March 28, about 9 o'clock, I saw in the southwest a light which at first was thought to be a reflection from the electric lights of Charles City, but it seemed brighter than those lights. After watching it for a time, I called my 14-year-old daughter and we agreed that it might be a fire. The fire, if it were such, would rise and fall, then suddenly it shifted to one side for as much as a rod and started to come toward the house; as it kept coming closer, I again called my daughter and she again confirmed my impression. By this time it was almost to our lane and moving slower; it stopped in the road just outside the lane for perhaps a minute and a half or two minutes. It appeared to be a globe of white light about the size of an ordinary lantern globe. The light from it was reflected perhaps 3 rods, and it seemed to rest about 2 or 3 feet above the ground. By this time we were both thoroughly frightened. As quickly as it had come it began to recede to where it was first seen. We watched it for a short time longer; it would come toward us a little way and then re-recede—*A. J. H.*

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